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FOREST INSECT INVESTIGATIONS

SOME FINAL FIELD EXPERIMENTS

on

OIL CONTROL OF PINE BARK BEETLES

Season of 1935

George D Hensill

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Season of 1935

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Scientific Aide

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SOME FINAL FIELD EXPERIMENTS ON OIL CONTROL OF PINE BARK BEETLES

Season of 1935

G. S. Hensill - Scientific Aide

Introduction

As the result of experimental laboratory work during the fall and winter season of 1934-35 it was felt that some further field experiments would be of value especially in regard to technique of application, possibility of development of new formulae and some other points which had been suggested.

Field Experiments of 1935

Object: To test the efficiency of certain oil formulae in bark beetle control on a practical basis. Emphasis to be placed on obtaining control on the sides and bottom of logs and in the thicker bark. Technique of application and amount of oil applied per unit area of bark surface will be the important factors of the experimental work.

Methods and Procedure:

1. These tests were all made on ponderosa pine infested with Dendroctonus brevicomis. The experimental trees were located partly in the Bass Lake area of the Sierra National Forest and in the Cascadel area of the same forest. The trees treated were treated between April 13 and May 10, and all contained overwintering brood mostly in the more advanced stages of development.

2. Tests of oil formulae were made by spraying sections of infested trees which had been felled. Sections including bark all around the bole were used wherever it was possible.

3. No definite amount of oil per unit area of bark surface was applied but spraying was continued until all the bark crevices had been filled and the surface was thoroughly wet.

4. Wherever possible sections of infested trees containing more advanced brood, large larvae, pupae or new adults were used for experimental tests and it was possible to do this in practically all cases.

5. Mortality checks on these tests were made by making emergence hole counts on sections of the bark after sufficient time had elapsed for complete emergence to have taken place. Following this sections of the bark were shaved up and the dead brood counted.

Results: The results of these experiments including the essential data are included in Table I. From the results of these tests the following factors are worthy of consideration:

1. On the whole, the brood mortality in these tests was higher on the average and more consistent than in any previous tests. This is probably due to two things; (1) the fact that oil was applied to the bark crevices and all parts of the bark were wet thoroughly and (2) the consequent larger amounts of oil which were applied as a result of this method of application. The average amount of oil applied in these tests was one gallon to thirteen square feet of bark surface as compared to the previously used amount of one quart to ten square feet, or approximately four times as much oil. (Fig.1) Exit hole counts were made during the latter part of September.

2. Substantiating the high brood mortality, bark counts for brood mortality in case of Trees 1 and 2 nine days after treatment, showed a mortality of 95% on the side of the log from both sections of Tree 1, and a mortality of 100% in a corresponding part of the bole of Tree 2.

3. In spite of the increased amount of oil applied no successful control was obtained on the bottoms of logs. This will make it essential that logs be rolled when sprayed, in order to obtain satisfactory results. Wherever the exit holes from all sides of a treated section were averaged the larger number on the bottom invariably brought the average down.

4. None of the formulas used were quite as efficient as the Standard Oil Company's Formula No. 21046-R. The formula using stainless, penetrating creosote with distillate and lubricating oil in certain proportions gave nearly as good results however, and on the basis of cost might be the most practical to use.

5. It was apparent throughout the tests that higher mortality resulted when the brood was in the more advanced stages, large or prepupal larvae, pupae or new adults, at the time of treatment. It was observed that development of brood and emergence from oil treated trees was slow and retarded, as compared to normal emergence. This was evident in the case of trees treated in the fall of 1934 as well as those treated in the spring of 1935. As was found in experimental work this delayed and slow development is particularly characteristic of larvae which have received only a light dose of oil. In laboratory tests

some larvae were observed to live for two or three weeks after a light treatment of oil without growth or development. Many of these retarded larvae pupated after some time and emerged as adults.

6. It is apparent from the results of these experiments that oil control of pine bark beetles, especially D.b. in ponderosa and D.m. in lodgepole pine, could be employed on a practical basis to a limited extent. As will be pointed out in a subsequent report, however, its use will undoubtedly be very limited due to cost of materials and extra labor involved.

Supplementary Experiments

1. Light and Heavy Applications of Oil

Object: To find the amount of variation in control between light and heavy applications of oil.

Methods and Procedure: The treated sections on one experimental tree were divided into two parts. The upper half of each section was treated with a light application of oil, one gallon to forty square feet of bark surface, the lower half of each section was treated with a heavy application of oil, one gallon to thirteen square feet of bark surface.

Results: One treated section out of four showed the expected results in this test. In this one section there were less exit holes in the lower heavily treated portion than in the upper lightly treated portion as would be expected. (Fig. 1) The other sections showed too variable results to be of any significance. The reason for failure of most of these tests is, most likely, the variation of brood pupulation throughout the treated areas. Bark shave counts showed a wide variation in the amount of dead brood per square foot. The various unfavorable bark characteristics may also have been responsible to some extent for the lack of expected results.

2. Biotic Potential of Adults Emerging From Oil Treated Trees

Object: To determine, if possible, whether adult bark beetles emerging as the survivors of oil treated brood are capable of making normal attacks and rearing normal broods.

Methods and Procedure: Approximately thirty square feet of brood bark from three different trees which had been treated with formula No. 21046-R was placed in a screen cage with a freshly cut ponderosa pine log one foot in diameter and two feet long.

Results: The emergence from the treated bark was very light and as a consequence there were but few adults to attack the log. A total of four attacks were made only one of which was successful due to considerable pitching-out. There were eleven emergence holes from the one successful attack. Too little evidence was obtained in this case to warrant any definite conclusion and it has been concluded that any worthwhile test of this nature should be conducted on a much more extensive scale. For best and most accurate results the emerging adults should be collected and placed in a cage on a live tree and not left to attack a log in the same cage with the treated bark from which they are emerging. An experiment of this type should be worthwhile and might give some very interesting results.

3. Final Check on Treated Trees of 1934 Project

Object: As a final check on brood mortality counts and the actual amount of control obtained exit hole counts were made on bark samples from four trees which had been treated in the fall of 1934.

Methods and Procedure: Samples of four square feet of bark were taken from near the same area on the log from which brood mortality counts had been made the previous fall. These samples were taken only from unexposed or protected locations where there was no possibility of sun-curing having occurred. Exit hole counts were made on the bark samples and the average number per square foot of bark surface determined.

Results: Table II shows how the exit hole counts correlated with the brood mortality counts. It gives an idea of how this method of determining brood mortality might be substituted for brood mortality counts, though it is best that both be made. Counts of dead brood in the bark may also be made to very good advantage. In using the exhit hole method it is essentail to have some idea of the heaviness of the brood in order that the full significance of the counts and mortality data be obtained.

Summary

Experimental results during the field season of 1935 resulted in higher mortality, on the whole, with toxic, penetrating oils than had been obtained in previous work.

It was found to be impossible to obtain satisfactory control on the bottoms of logs unless the logs were rolled and the bottom half given a separate treatment from the top half.

Formula No. 21046-R of the Standard Oil Company was found to be the most efficient oil used through several years of experimental work. The next best formula was a mixture of stainless, penetrating creosote, diesel oil and lubricating oil.

Higher brood mortality resulted and better control was obtained in those cases where the brood was in more advanced stages, pupae and new adults, at the time of treatment.

Oil control of western pine beetle in ponderosa pine will be very limited due to the many factors which must be considered and the difficulties to be overcome.

Heavy applications of oil were found to be more effective than the lighter applications which had been previously used.

There is some possibility that the biotic potential of adult beetles emerging as survivors from oil treated brood may be affected. No definite conclusion as to this could be made, however, unless some extensive experiments were conducted.

The most accurate check as to brood mortality in oil treated bark is obtained by a combination of brood mortality counts, exit hole counts and counts of dead brood per square foot of bark.

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TABLE I. - RESULTS OF OIL TREATMENT FOR CONTROL OF WESTERN PINE BEETLE IN BARK OF PONDEROSA PINE - 1935

Tree No.	Section No.	Expos-	Area of Section in sq. ft	Oil Formula Applied	Amount of oil applied	Exit Holes per sq.ft.	No.sq.ft. averaged	Dead Brood per sq. ft.	Bark Thickness
1	1	T&S	95	21046-R	5 gal	8.5	8	130	1 1/8-1"
1	2	All	73	24241-R,75%;25169-R,25%;Naph. 1 lb. per gal.	4.75 "	21	8	316	1"-¾"
1	Check	W				51	4	84	¾"
2	1	T&S	33.6	24241-R,50%; creosote 50%	2.5 "	4	8	248	1"-¾"
2	Check	N				31	4	94	¾"
3	1	N	10.4	24241-R,75%;25169-R,25%; ODB 3/4 lb. per gal.	1.0 "	8	4	30	1"
3	2	N	28.4	24241-R,75%;25169-R,25%; BN 3/4 lb. per gal.	2.5 "	2.25	4	210	1"
3	3	N	33.6	24241-R,75%;25169-R,25%; Naph. 1 lb. per gal.	2.5 "	6	4	118	¾"
3	Check	N				38	3	0	1"
4	1	All	40.15	24241-R,50%; creosote 50%	3.0 "	7	16	151	2"
4	2	All	35	24241-R,50%; creosote 25%; 25169-R,25%	4.0 "	2	16	167	2"
4	3	N	25.2	21046-R	2.5 "	1	4	98	1¾"
4	Check	N				23	4	10	1½"
5	1	S	10.8	24241-R,50%; creo 25%;25169-R,25%;Naph.½lb/gal.	1 "	14	4	210	1½"
5	2	S	12.6	24241-R,50%; creo 25%;25169-R,25%;Naph.½lb/gal.	1 "	23	4	322	1"
5	3	S	12.6	24240-R,75%; creosote 25%	1 "	15	4	352	1"
5	4	S	11.1	21046-R	1.25 "	7	4	224	1"
5	Check	S				59	4	0	1½"

Abbreviations: T= Top S= South N=North W= West
Creo. = Reilly stainless, penetrating creosote
Naph. = Naphthalene
BN = Beta naphthol
ODB = Orthodichlorobenzene

TABLE II. - COMPARISON OF BROOD MORTALITY COUNTS AND EXIT HOLE COUNTS FROM OIL TREATED PONDEROSA PINE TREES

Tree No.	Exposure of Sample	Bark Thickness	Exit Holes per sq.ft.	Brood Mortality	Oil Formula Used
1	Bottom	1"	37	28%	24241-R,50% 24240-R, 50% and naphthalene $\frac{1}{2}$ lb. per gallon
2	No. Side	$\frac{3}{8}$"	4	94%	21046-R of Standard Oil Company
2	Bottom	$\frac{3}{4}$"	4	80%	
3	No. Side	$1\frac{1}{4}$"	7	56%	24241-R,75%; 24240-R,25%; and naphthalene $\frac{1}{2}$ lb. per gallon
3	No. Side	$\frac{3}{4}$"	5	80%	
4	East Side	$\frac{3}{8}$"	7.5	89%	24241-R,25%; 24240-R,75% and paradichlorobenzene 45 grams per gal.

Figure 1.

Beetle emergence from oil treated and untreated bark. (Dendroctonus brevicomis in ponderosa pine) Left, untreated; center, treated at rate of one gallon per 35 square feet; right, treated at the rate of one gallon per 13 square feet.

One toothpick in each exit hole.